

Real-Time Online Monitoring and Adaptive Control of Nano-Second Pulsed Laser Scribing Process Utilizing Spectrometer

ICALEO 2016 # 0761-000313

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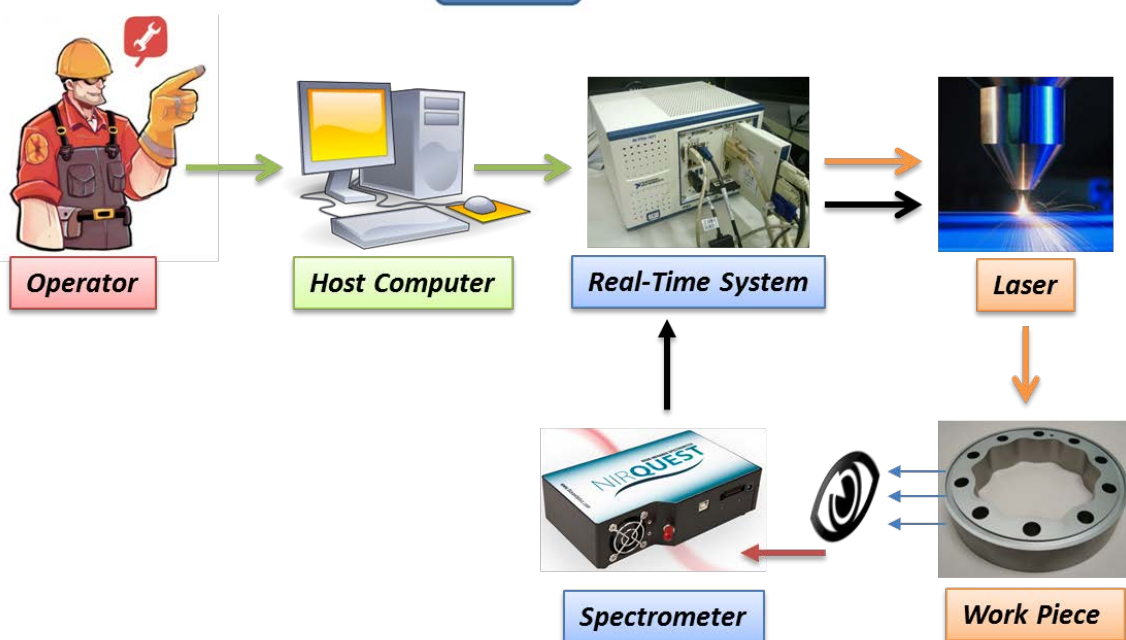
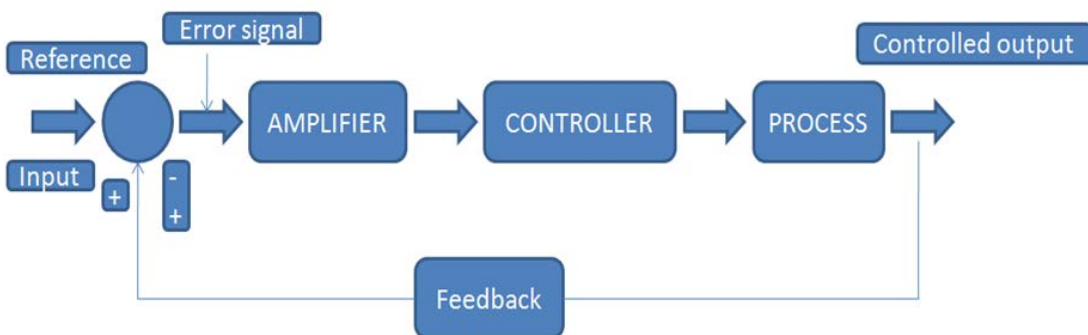
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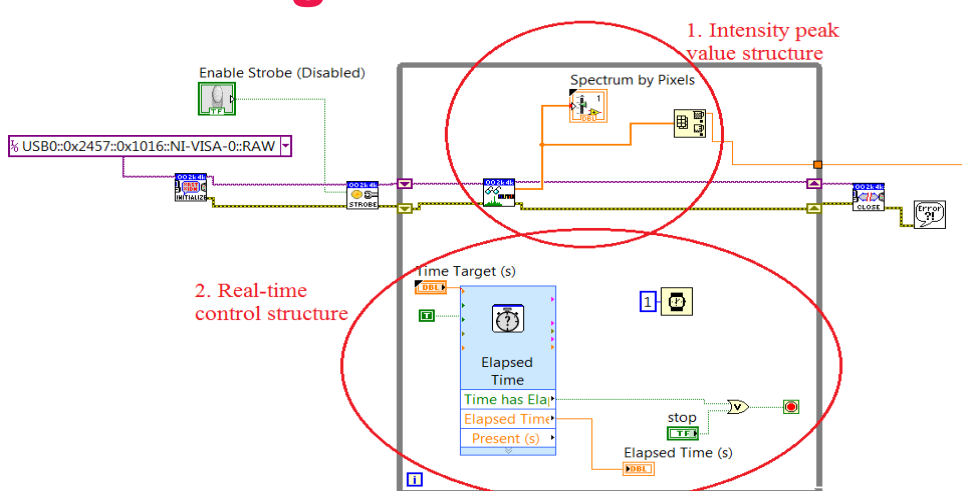
Introduction

Laser scribing is considered to be very fast and accurate process and thus it would be necessary to develop accurate tuning and monitoring system for such a process. This research focuses on developing real-time adaptive control for ultra-fast laser scribing processes utilizing spectrometer online monitoring. The control algorithm for laser parameter's tuning is developed using National Instrument's LabVIEW and a spectrometer is being utilized in online monitoring. Results are based on behavior of the control strategy and accuracy of the spectrometer monitoring when scribing different steel materials.

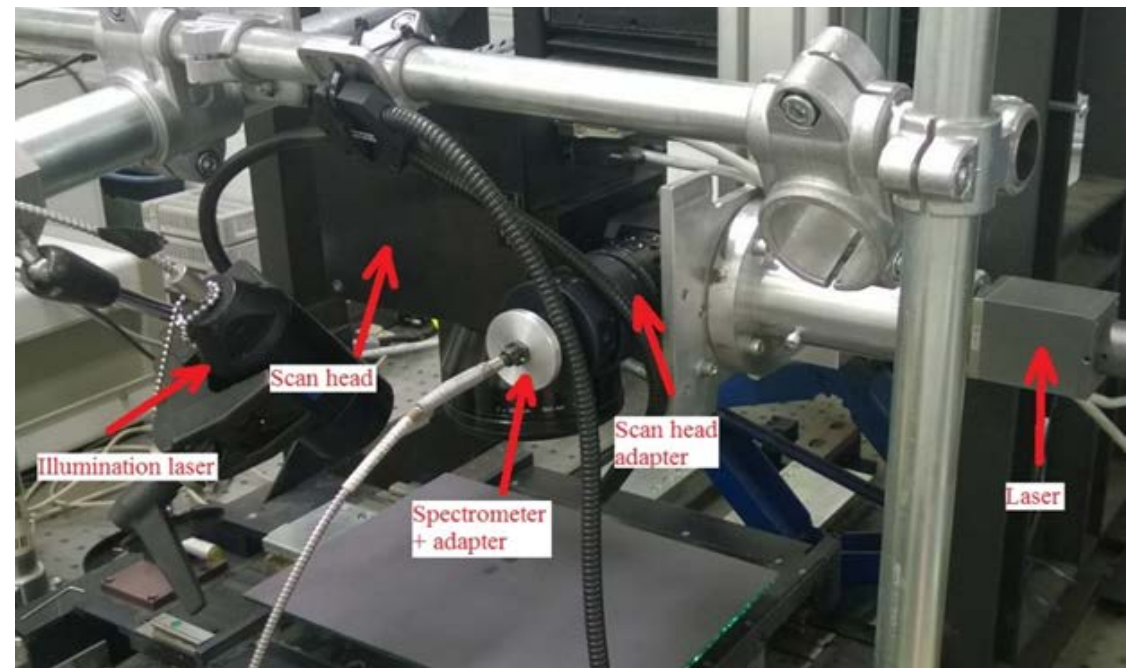
Control Strategy



Control Algorithm

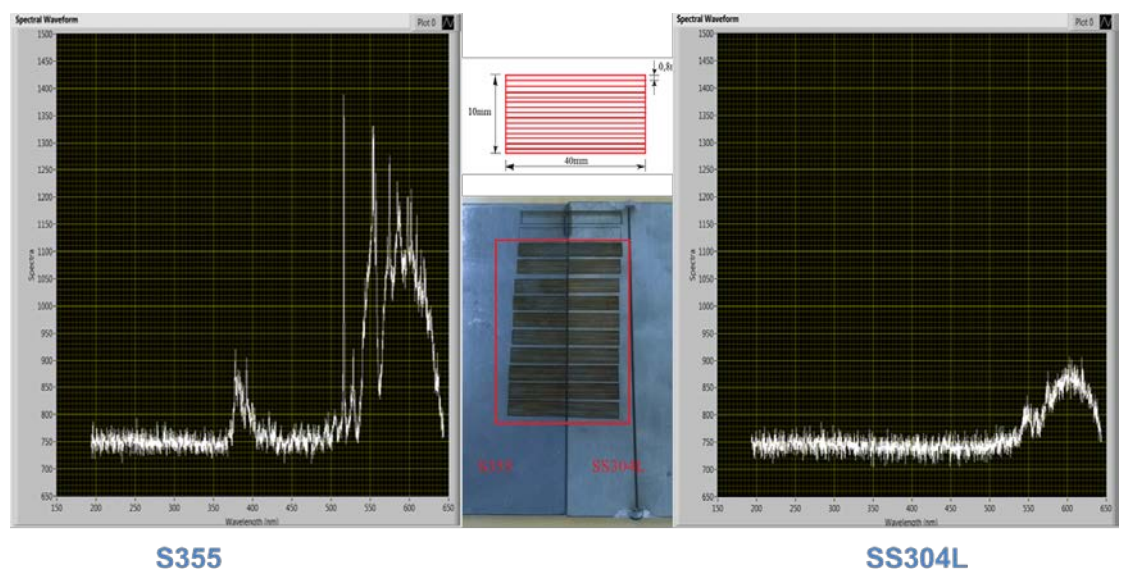


Test Setup



Experiment

Experiments were performed to test real-time capability of the laser control algorithm. Experiments were started by choosing two different materials to see how the control code behaved when scribing moved from one material to another. Materials were chosen to be stainless steel SS304L and steel S355. Beam hatch shape was rectangular with dimensions of 40x10mm² with 0.8mm horizontal hatch space.



Conclusion

Based on the results achieved, spectrometer is very capable of online monitoring of laser engraving processes. In addition, the developed adaptive control system successfully controls the laser parameters during the scribing process based on the spectrometer outputs.